(12) UK Patent Application (19) GB (11) 2 280 504 (13) A

(43) Date of A Publication 01.02.1995

(21) Application No 9315548.9

(22) Date of Filing 28.07.1993

(71) Applicant(s)
Data Stream Corporation

(Incorporated in Japan)

2719 Kamituruma, Sagamihara-shi, Kanagawa-ken, Japan

(72) Inventor(s)
Hajime Suzuki
Tetsuji Aoyagi

(74) Agent and/or Address for Service
Mewburn Ellis
York House, 23 Kingsway, LONDON, WC2B 6HP, United Kingdom

(51) INT CL^6
G01S 5/16, G01B 11/03, G06F 3/037

(52) UK CL (Edition N)
G1A AA3 AEE AG17 AR6 AR7
U1S S2123

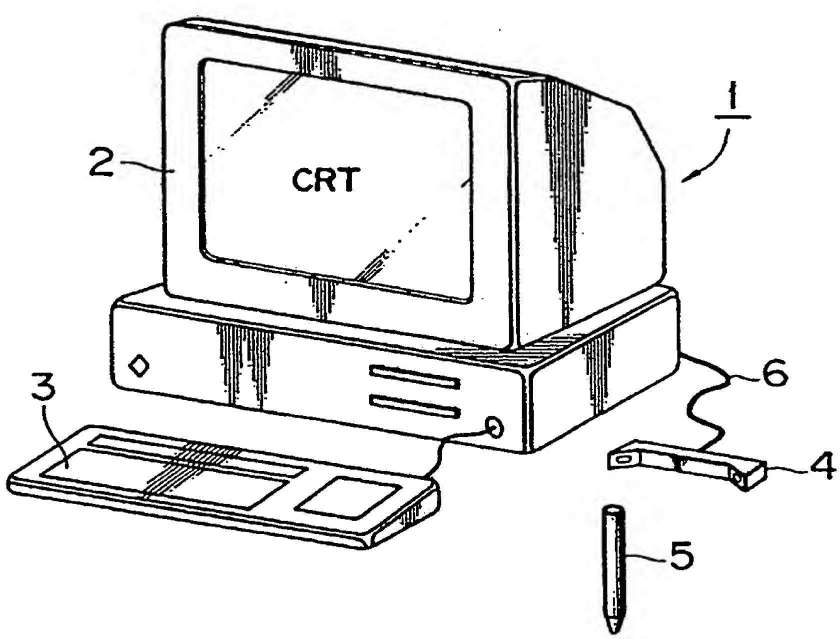
(56) Documents Cited
GB 2263546 A WO 88/04060 A1 WO 84/03774 A

(58) Field of Search
UK CL (Edition L) G1A AEE AEN, H4D DLPC
INT CL^5 G01B 11/03, G01S 5/16, G06F 3/033 3/037
Online database :WPI

(54) Position data input system for computer.

(57) A data input system for a computer (1) comprises a transmitting device (5) having at least one source (10a, 10b) of pulsed light, and a position data receiving device (4) including at least two light receiving elements (20, 21) for detecting the light coming from said source of light and a calculating portion for calculating a three-dimensional spatial position of at least one portion of the transmitting device from the quantities of the light detected by said light receiving elements. The transmitting device (5) may have light sources at each end which produce pulse at different frequencies, the pulses being modulated in accordance with the on/off state of switches on the transmitting device. The two light receiving devices may be quadrant detectors.

FIG. 1



GB 2 280 504 A

FIG. 1

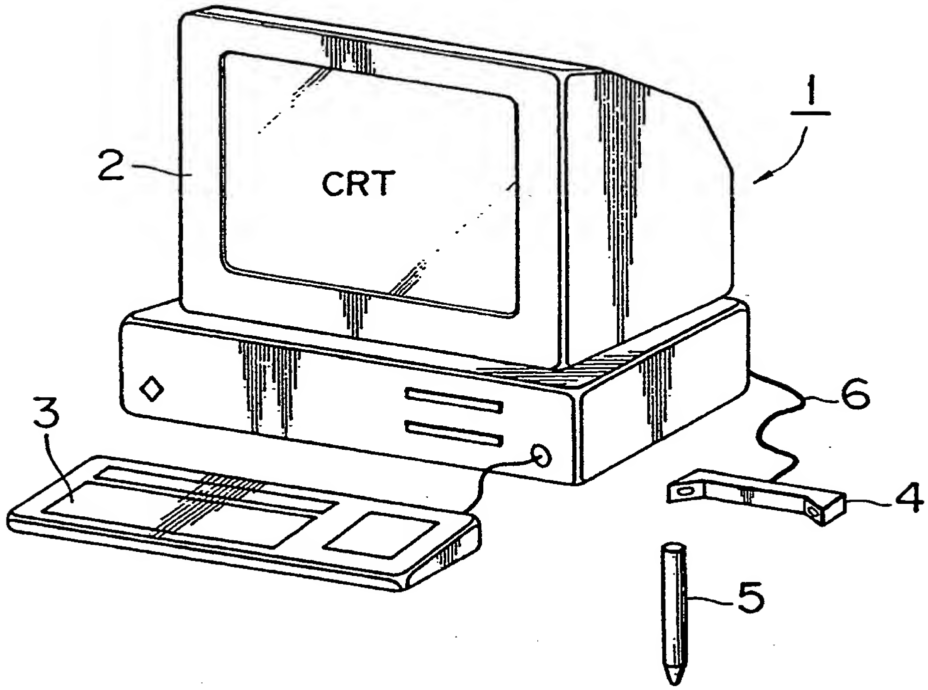


FIG. 2

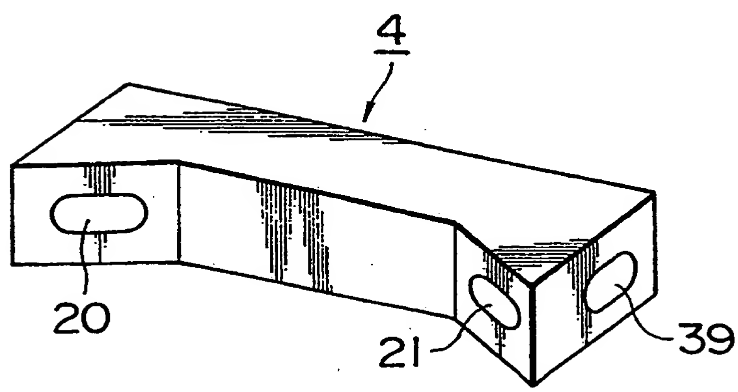


FIG. 3

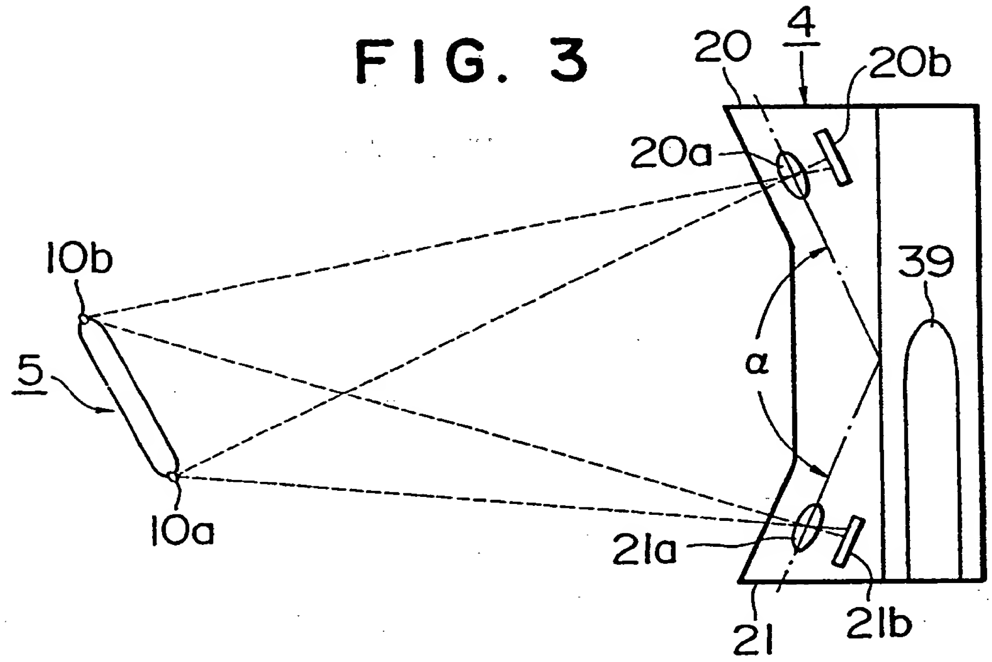


FIG. 4

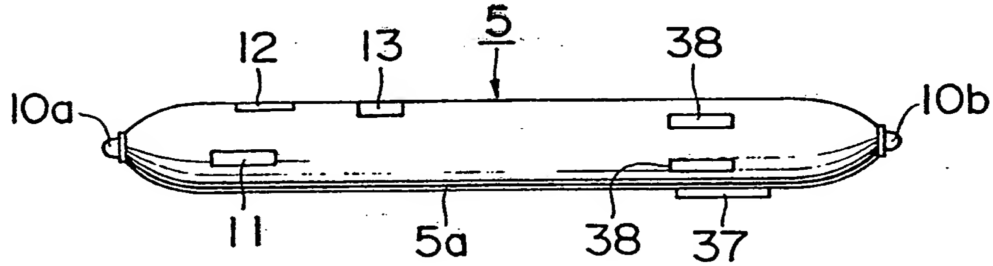


FIG. 5

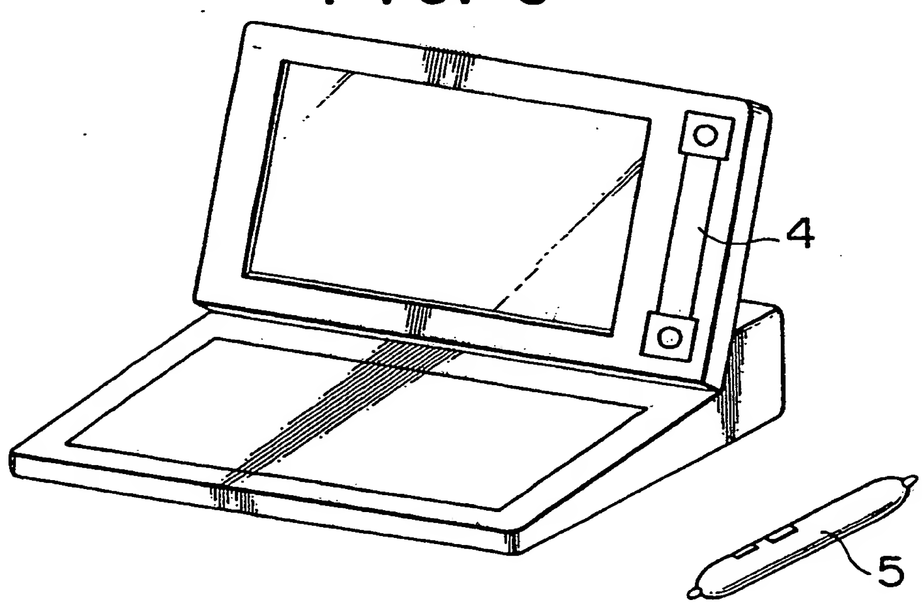


FIG. 6

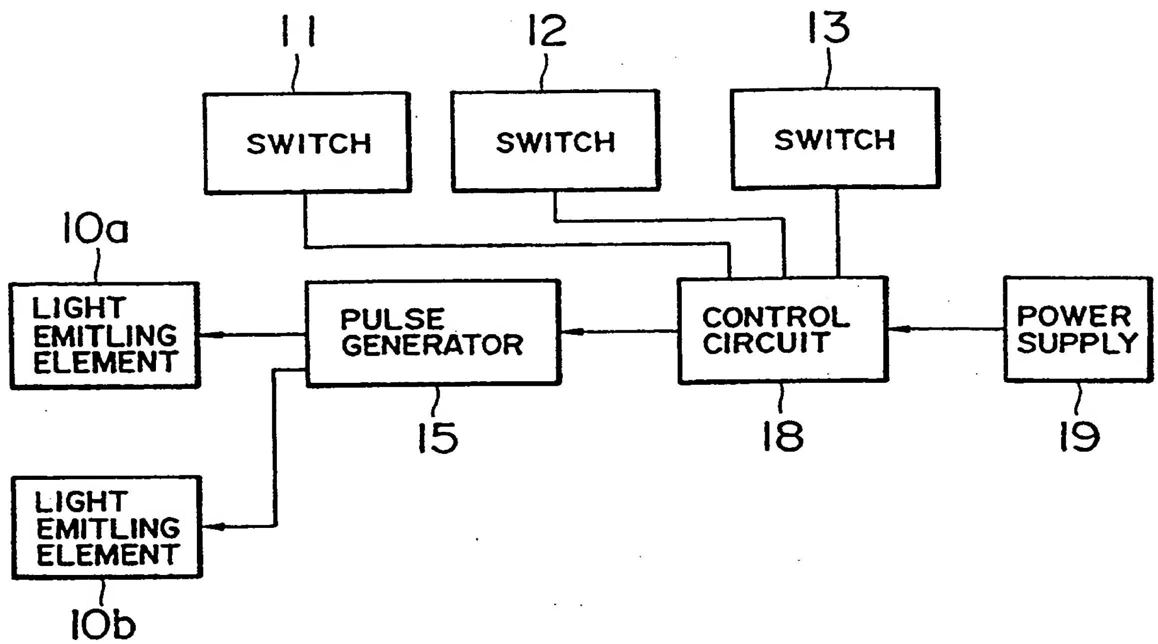

11
12
13
SWITCH
SWITCH
SWITCH
10a
LIGHT EMITLING ELEMENT
PULSE GENERATOR
CONTROL CIRCUIT
POWER SUPPLY
15
18
19
LIGHT EMITLING ELEMENT
10b

FIG. 8

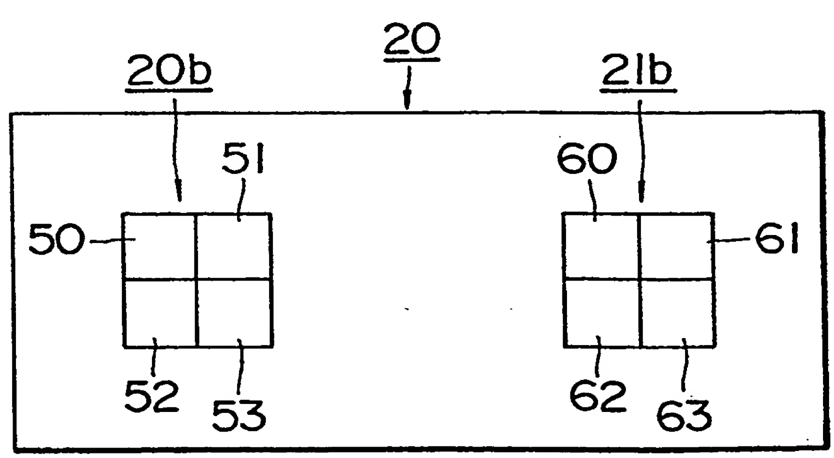

20
20b
21b
51
60
50
61
52
53
62
63

FIG. 7

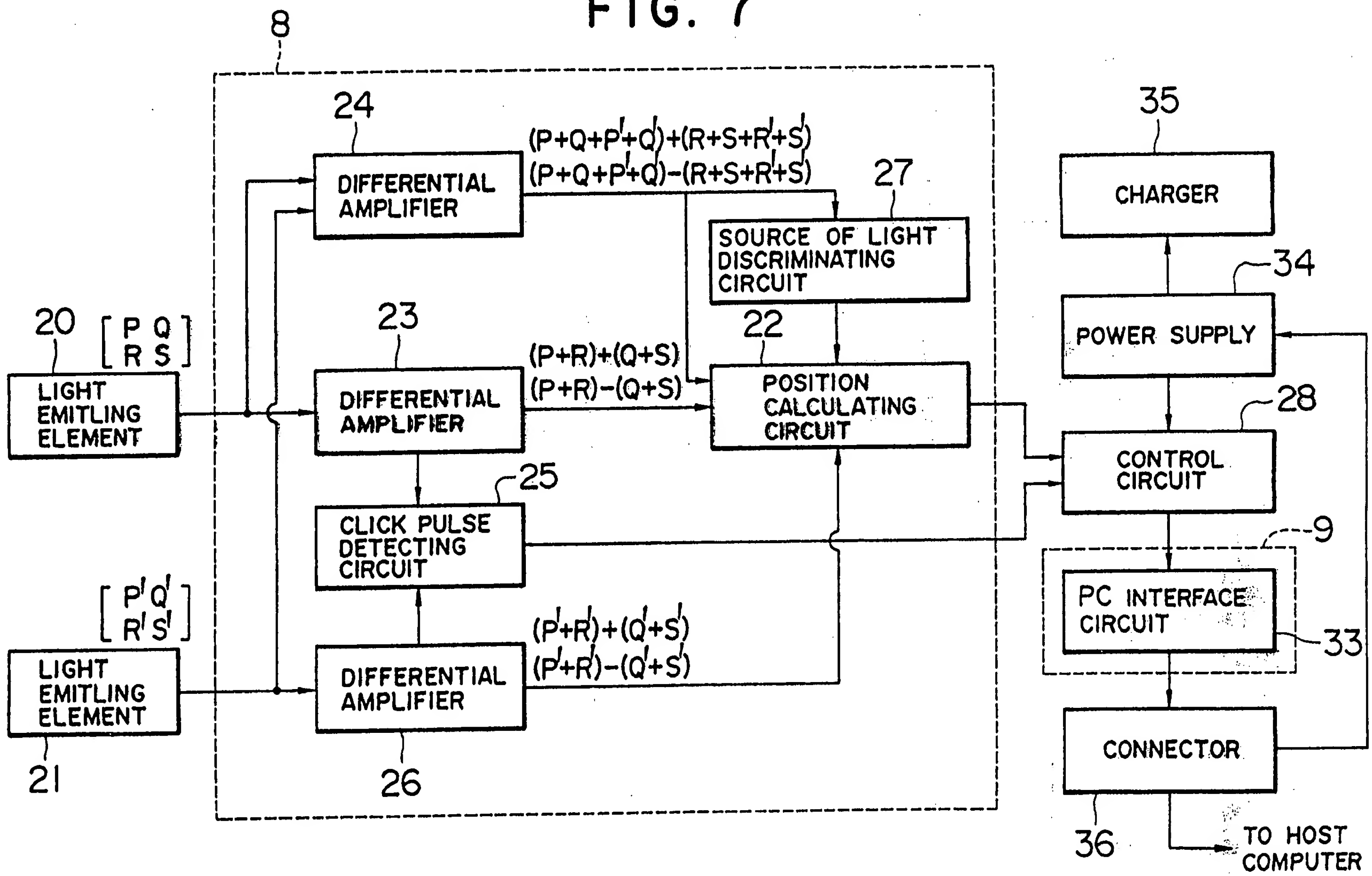

8
20
P Q
R S
LIGHT EMITLING ELEMENT
P' Q'
R' S'
LIGHT EMITLING ELEMENT
21
24
DIFFERENTIAL AMPLIFIER
23
DIFFERENTIAL AMPLIFIER
25
CLICK PULSE DETECTING CIRCUIT
DIFFERENTIAL AMPLIFIER
26
(P+Q+P'+Q')+(R+S+R'+S')
(P+Q+P'+Q')-(R+S+R'+S')
27
SOURCE OF LIGHT DISCRIMINATING CIRCUIT
22
(P+R)+(Q+S)
(P+R)-(Q+S)
POSITION CALCULATING CIRCUIT
(P'+R')+(Q'+S')
(P'+R')-(Q'+S')
35
CHARGER
34
POWER SUPPLY
28
CONTROL CIRCUIT
9
PC INTERFACE CIRCUIT
33
CONNECTOR
36
TO HOST COMPUTER

FIG. 9

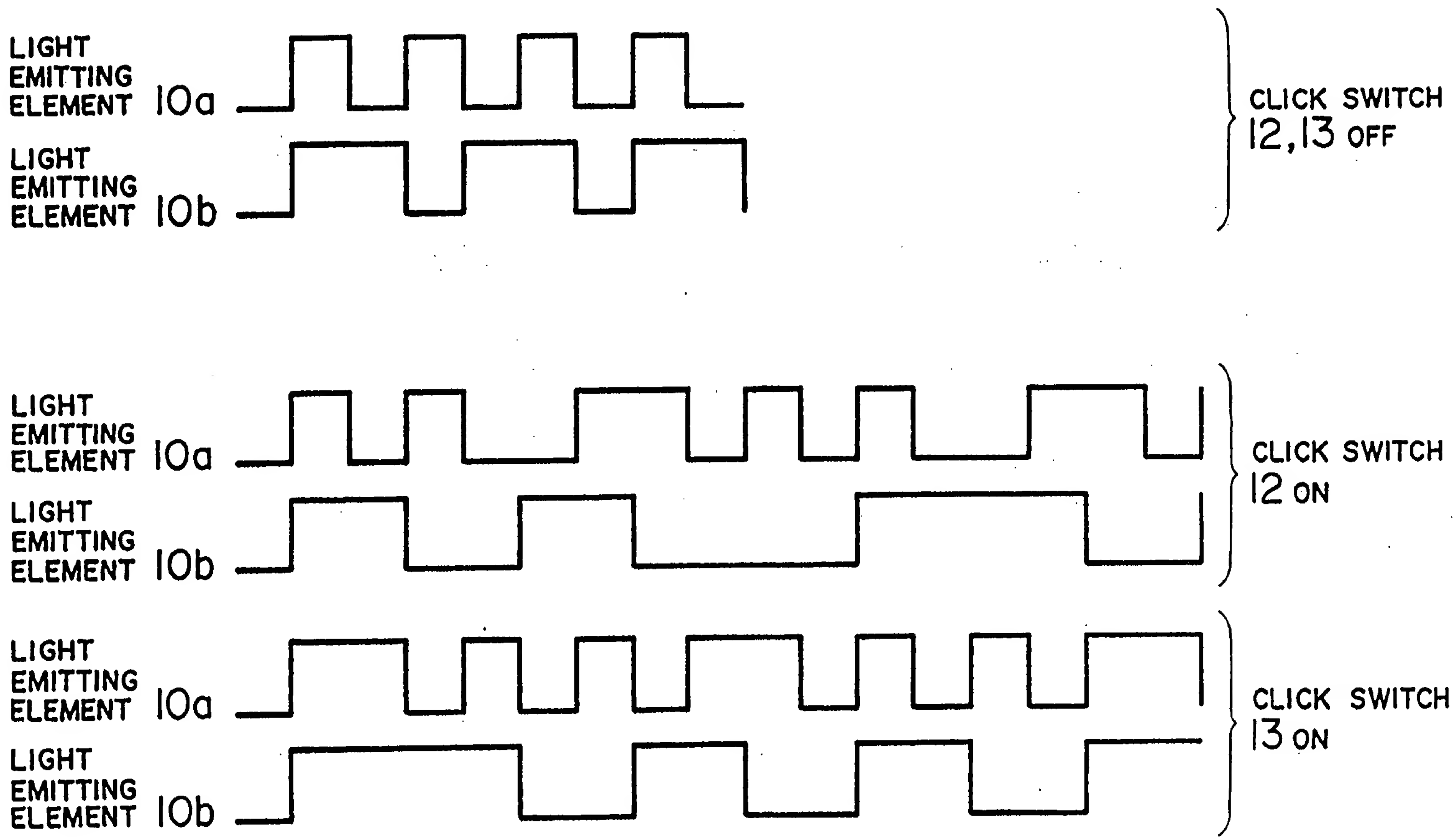

LIGHT EMITTING ELEMENT 10a
LIGHT EMITTING ELEMENT 10b
CLICK SWITCH 12,13 OFF
LIGHT EMITTING ELEMENT 10a
LIGHT EMITTING ELEMENT 10b
CLICK SWITCH 12 ON
LIGHT EMITTING ELEMENT 10a
LIGHT EMITTING ELEMENT 10b
CLICK SWITCH 13 ON

FIG. 10

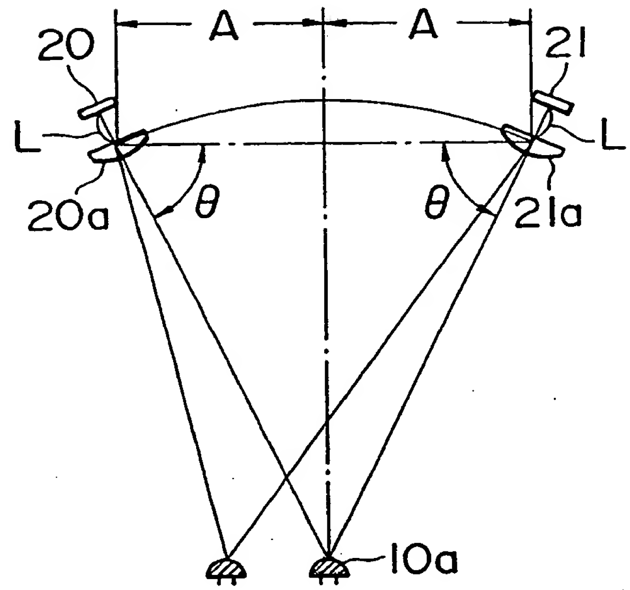

A
A
20
21
L
L
20a
21a
θ
θ
10a

FIG. 11

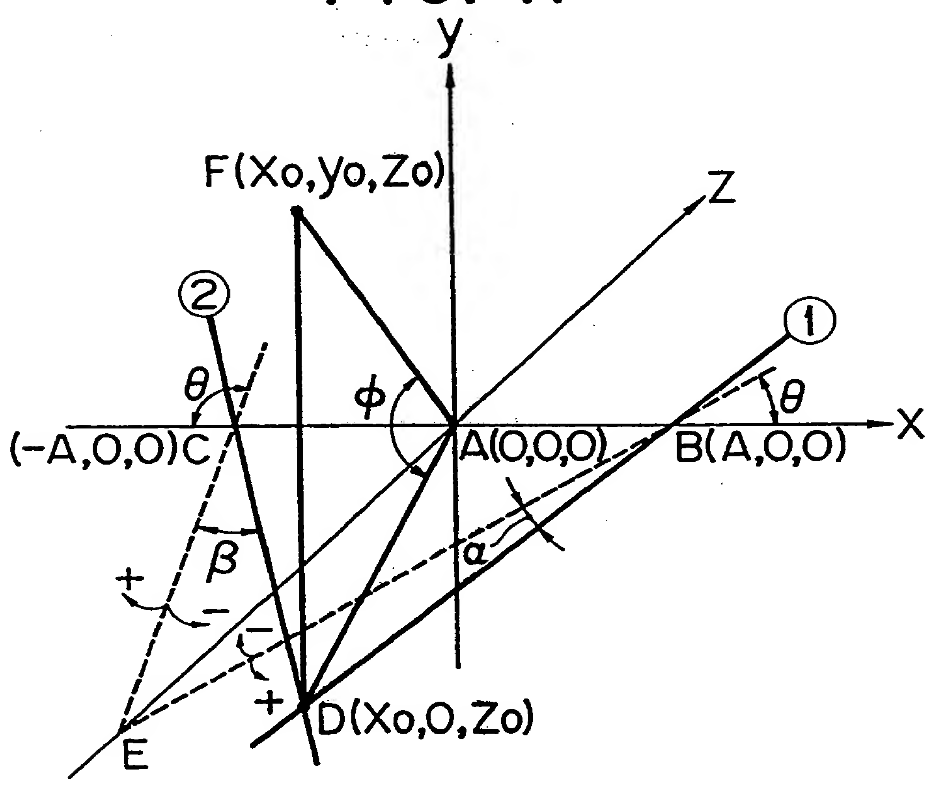

y
F(Xo,yo,Zo)
Z
2
1
θ
φ
θ
X
(-A,0,0)C
A(0,0,0)
B(A,0,0)
β
α
+
−
−
+
E
D(Xo,0,Zo)

FIG. 12

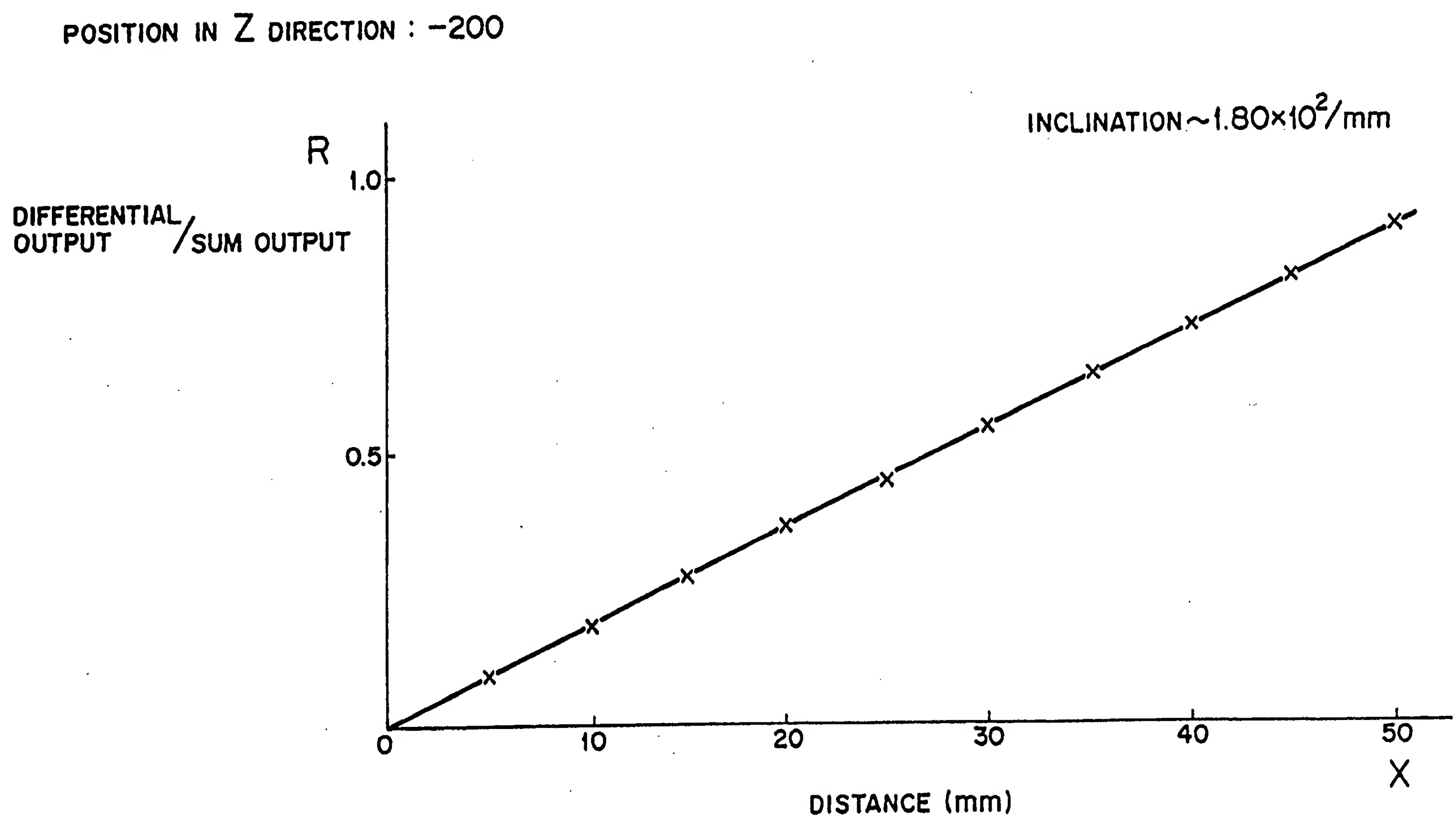
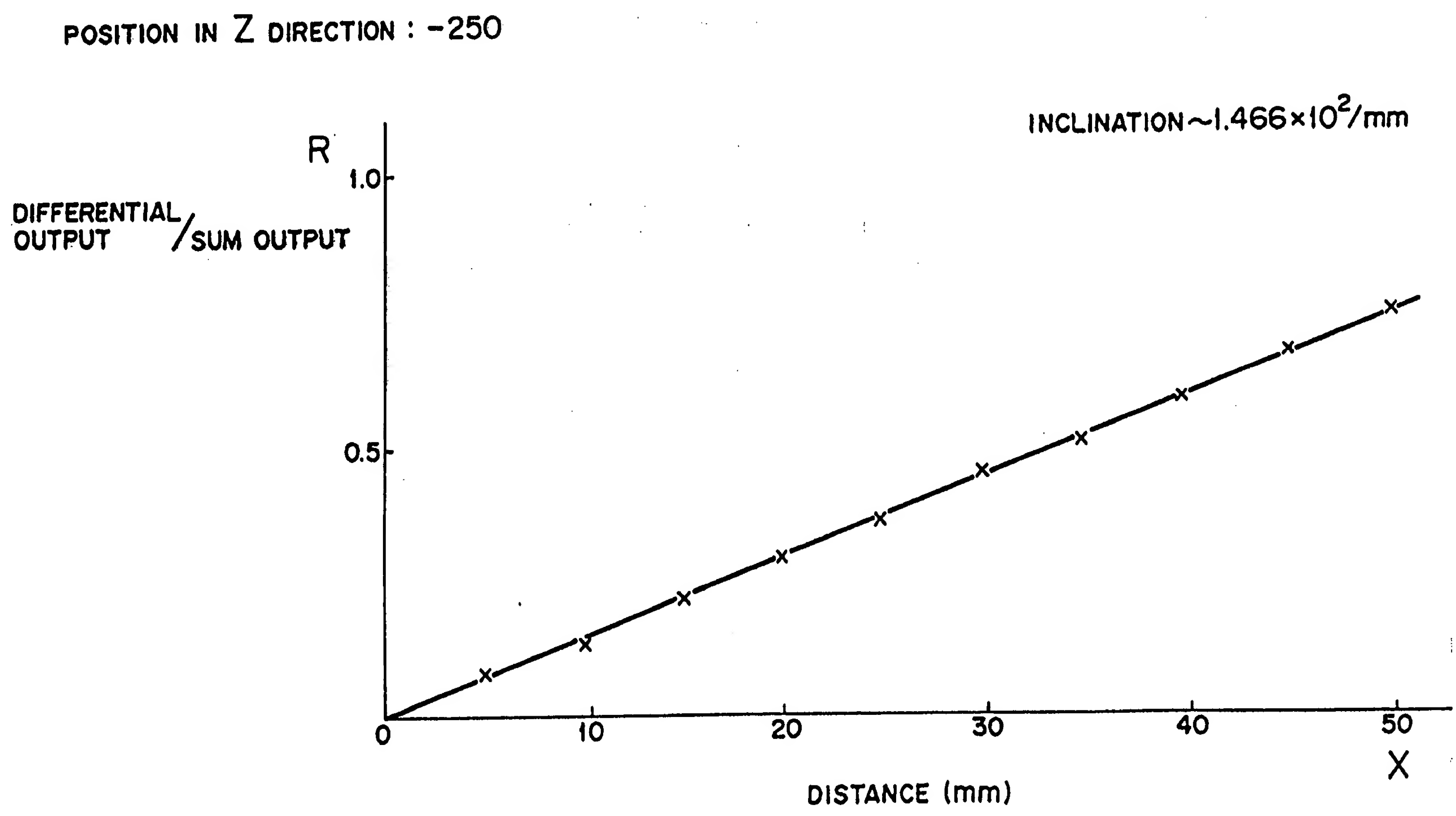

POSITION IN Z DIRECTION : −200
INCLINATION~1.80×10²/mm
R
DIFFERENTIAL OUTPUT / SUM OUTPUT
1.0
0.5
0
10
20
30
40
50
X
DISTANCE (mm)

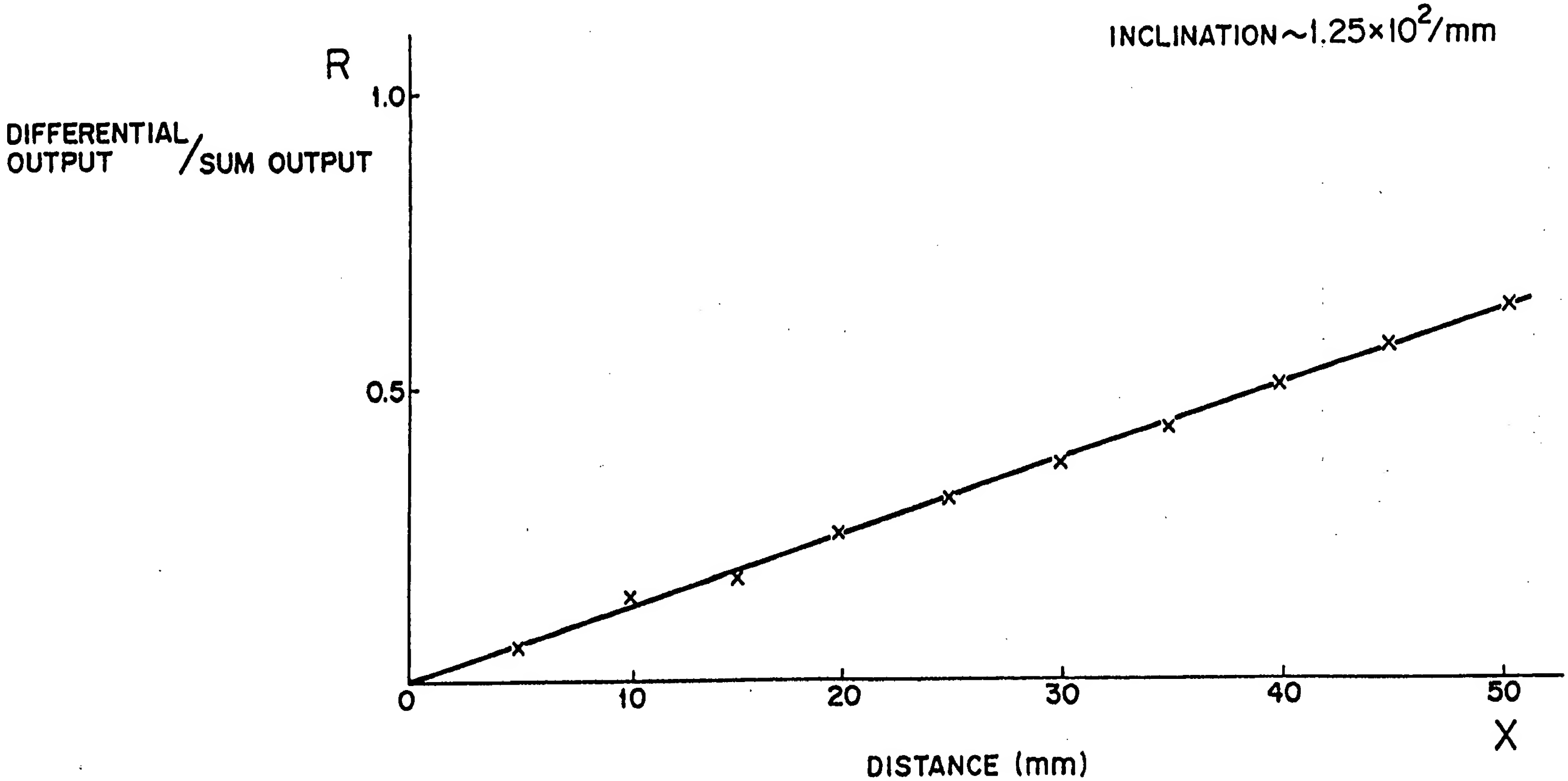
FIG. 13


POSITION IN Z DIRECTION : −250
R
DIFFERENTIAL OUTPUT /SUM OUTPUT
1.0
0.5
INCLINATION~1.466×10²/mm
0
10
20
30
40
50
X
DISTANCE (mm)

9/9

FIG. 14

POSITION IN Z DIRECTION : -300



SPECIFICATION

POSITION DATA INPUT SYSTEM FOR COMPUTER

BACKGROUND OF THE INVENTION

This invention relates to a data input system for a computer. More particularly, it relates to a wireless type of data input system. Since it is preferred that the invention is applied to a wireless type of position data input system, the following explanation is directed to such a system. However, the invention is not limited to the wireless type and includes a wire type.

Conventionally, in order to input the outline or the position of an object to a computer, users relied on an expensive device utilizing a laser light or a camera. However, with such a device it was difficult to detect a three-dimensional position abscissa at any spacial position. In other words, there have been no devices which users can easily and conveniently handle.

Of recent years, production of a three-dimensional image of an object or a cubic figure is often made by using a computer graphic, a CAD, a CAM or the like. However, the inputting of the data is made by independently inputting an x-y plane abscissa and a z axis abscissa. In order to input the outline of an actaul object, it is required to measure the size at three directions of x, y, and z axes. In such a case, it would be desirable to input a cubic information by tracing the outline of the object with a pen.

Furthermore, with virtual reality, there has been no convenient method by which a user inputs a cubic information. Particularly, in case of handling the cubic information, a wireless type of compact system is desired.

SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to provide a position data input system for inputting multi-dimensional position data to a computer.

It is another object of the invention to provide a relatively simple construction of wireless type of a three-dimensional position data input system for inputting three-dimensional position data to a computer.

In order to accomplish these objects, there is provided a multi-dimensional data input system for a computer which comprises a position data transmitting device having at least one source of light capable of emitting a light pulse, and a position data receiving device including at least two light receiving elements for detecting the light incoming from said source of light and a calculating portion for calculating a three-dimentsional position of at least one portion of position data receiving device in space from the quantities of the light detected by said light receiving elements

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing an overall construction of a wireless type of a three-dimensional position input system for a computer,

Fig. 2 is a perspective view showing a position data receiving device used in a wireless type of a three-dimensional position input system,

Fig. 3 is a top plan view showing a position data receiving device,

Fig. 4 is a top plan view showing a position data transmitting device,

Fig. 5 is a perspective view showing an overall construction of a wireless type of a three-dimensional position input system for a computer in accordance with the present invention applied to a lap top computer,

Fig. 6 is a circuit block diagram of a position data transmitting device,

Fig. 7 is a circuit block diagram of a position data receiving device,

Fig. 8 is a front view showing four-division PIN photodiodes disposed in a position data receiving device,

Fig. 9 is a waveform of a light pulse at various states of click switches in a position data transmitting device,

Fig. 10 is a diagrammatical view for explanation on calculation of a three-dimensional position at a wireless type of a three-dimensional position input system for a computer,

Fig. 11 is a diagrammatical view for explanation on calculation of a three-dimensional position at a wireless type of a three-dimensional position input system for a computer,

Fig. 12 is a graph for determining a parameter used for calculation of a three-dimensional position,

Fig. 13 is a graph for determining a parameter used for calculation of a three-dimensional position, and

Fig. 14 is a graph for determining a parameter used for

calculation of a three-dimensional position,

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1 through 5, there is shown a wireless type of a three-dimensional position data input system for a computer utilizing exisiting computers without any modification. In Fig. 1, a wireless type of a three-dimensional position data input system for a computer comprises a three-dimensional position data receiving device 4, hereinafter referred to as a position data receiving device, and a three-dimensional position data transmitting device 5, hereinafter referred to as a position data transmitting device 5. The position data transmitting device 4 is connected through an interface cable 6 to a personal computer body 1 which is in turn connected to a CRT 2 and a keyboard 3. The position data transmitting device 5 is adapted to be mounted in the charging portion 39 of the position data transmitting device 4 when not used, and is pulled out of the charging portion 39 when used. It is preferred that the position data transmitting device 5 is of a pen type, as shown in Figs. 1, 4 and 5, which is convenient for a user to handle by his hand. The position data transmitting device 5 is adapted to transmit two or one position data, representave of two or one position at which two or one portion of the body of position data transmitting device 5 is located in space, to the position data receiving device 4.

Fig. 5 shows an embodiment in which the position data receiving device 4 is included in a lap top computer. In the case, its optical and electrical constructions are the same as those shown in Fig. 1, and therefore the detailed explanation thereof is omitted.

Referring to Figs. 2 and 3, the position data receiving device has a box-like casing which has opposite front surface portions extending inclinedly outward. Each of the opposite portions is formed with an opening. The light receiving elements 20 and 21 are disposed in the casing to receive the light through the openings from the position

data transmitting device 5.

The light receiving element 20 comprises a lens 20a for focusing the light from the position data transmitting device 5 and a position detecting light/electric transducer 20b such as a four-division PIN photodiode disposed on the focused position for detecting the light image and transducing the quantity of light into an electric signal. Similarly, the light receiving element 21 comprises a lens 21a for focusing the light from the position data transmitting device 5 and a position detecting light/electric transducer 21b such as a four-division PIN photodiode disposed on the focused position for detecting the light image and transducing the quantity of light into an electric signal. These light receiving elements 20 and 21 are disposed to make an angle α therebetween. Consequently, the three-dimensional position of the position data transmitting device 5 is calculated from a distance between the light receiving elements 20 and 21, the angle α and the electric outputs from the four-division PIN photodiodes 20b and 21b, hereinafter described in detail.

Referring to Fig. 4, the position data transmitting device 5 comprises light emitting elements or electric to light transducers 10a and 10b such as LED at the opposite ends thereof, a mouse switch 11, and click switches 12 and 13 at the front portion thereof, and an accommdation guide bar 37 and an electric charging terminals 38 at the rear portion thereof.

The light emitting elements 10a and 10b transduce three-dimensional position data, rotation information and click information into a light in accordance with the order from a control circuit, described later. For example, when a mouse switch 11 is depressed by a user's thumb, it emits a light in the form of pulse including position information which is generated within a device body 5a. Furthermore, the light receiving element provided within the position data receiving device 4 is usually responsive to a visual light, the light receiving element is provided with a filter, not shown, for

passing only a light in a particular wavelengh, usually a ultra-red light. When the mouse switch is depressed, the position data transmitting device becomes active, and then the position pulses generated within the device body are emitted. When the click switches 12 and 13 are depressed by a user's forefinger, these switches are operated as a click-on switch and a click-off switch. Furthermore, these switches become active only when the position data transmitting device is on by the mouse switch 11. Furthermore, two click switches are not necessarily provided, and only the click-on switch is used and the click-off switch 13 may be omitted.

The light emitting elements 10a and 10b are modulated with ID code including click information and alternately emit the light. From this, it can be known which light emitting element emits and whether click switches are depressed.

The accommodation guide bar 37 functions as a guide when the position data transmitting device 5 is accommodated into the charging portion 39 of the position by sliding the device body 5a along the guide grooves, not shown, provided within the charging portion 39. Consequently, the charging terminals 38 of the position data transmitting device 5 is positioned relative to the corresponding charging terminals, not shown, of the position data receiving device 4. Furthermore, the position data transmitting device 5 has other functional elements, which will be described in detail with refernce to Fig. 6.

An explanation on the circuit cnostruction of the wireless type of multi-dimensional position data input system comprising the position data transmitting and receiving devices will be made with reference to Figs. 6 and 7.

Referring first to Fig. 6, there is shown a circuit block of the position data transmitting device 5. The light emitting elements 10a and 10b are electric to light transducers as mentioned above, and emit

the light in the form of pulse for descriminating whether each of click switches are on or off.

A pulse generator 15 generates a position pulse in accordance with the states of the mouse switch 11 and the click switches 12 and 13 under the control of a control circuit 18. The mouse switch 11 is to switch over between operation state and non-operation state of the position transmitting device 4, and the click switches 12 and 13 generate a click-on signal and a click-off signal, respectively, from which the click-on and click-off pulses are generated. The control circuit controls an overall operation of the position data transmitting device. Furthermore, a source of power 19 is charged through the charging terminals 38.

Referring now to Fig. 7, there is shown a circuit block of the position data receiving device 4. The light receiving elements 20 and 21 receive the light from the position data transmitting device 5 as mentioned above. The two light receiving elements 20 and 21 are connected to a detecting and calculating circuit 8, which includes differential amplifiers 23, 24 and 26, a click pulse detecting circuit 25, a source of light discriminating circuit 27 and a position calculating circuit 22. Each of the differential amplifiers 23, 24 and 26 outputs the difference between the electric quantities corresponding to the quantities of light which are received by the four-division PIN photodiodes 20 and 21, and the sum of them, hereinafter described in detail. The source of light disciminating circuit 27 discriminates with ID code which light emitting element 10a or 10b now emits. The click pulse detecting circuit 25 detects whether the electric signal transduced from the received light includes the click pulses or not. That is, it detects on or off states of the click switches. Furthermore, the detection of the click pulses may be made by judging the outputs of the light receiving elements since the incoming light is discriminatingly modulated in accordance with the on or off state of the click switches. The position calculating circuit 22 calculates the position of the

position data transmitting device from the quantities of the lights and other constants. The control circuit 28 controls an overall operation of the position data receiving device. The control circuit 28 also functions as an I/O digital circuit which reads the value of the position calculated by position calculating circuit 22, the posture of the position data transmitting device and the click pulse information obtained by the click pulse detecting circuit 25. Furthermore, it is used as a conventional two-dimensional mouse when it is connected to a conventional mouse port.

Furthermore, a connector 36 is provided for transferring the positon pulse and mouse click pulse, which are generated by a PC interface circuit 33, through the mouse cable 6 to the personal computer 1 (see Fig. 1) and for supplying the electric power to the position data receiving device 5. A power supply 34 supplies an electric power to the control circuit 28 and other functional elements. Furthermore, a charger 35 is connected to the above-mentioned charging portion 39 to supply an electric power to the position data transmitting device 5.

An explanation on the detection of the position will be made with reference to Figs. 10 through 14. Fig. 10 shows various parameters associated with an optical system to be set in order to calculate a three-dimensional position of the position data transmitting device are as follows:

(1) Lens: diameter, radius of curvature, refractive index and thickness of lens,

(2) Distance between light receiving elements: l (a distance between the center of the lens and the light receiving element), since this distance relates to a diameter of the spot of light and ratio (R) of the the difference and the sum of the quantities of the light described later, an appropriate value should be selected.

(3) Distance between the lenses: 2A, and

(4) Inclined angle of the each lens: θ

Fig. 11 shows an optical system for calculating the position of the source of light <u>a.</u> The following two equations are derived from these abscissa:

$z = \tan(\theta + \alpha)X - \tan(\theta + \alpha)A$ (1)

$z = \tan(\theta + \beta)X - \tan(\theta + \beta)A$ (2)

Wherein θ is an angle between the optial axis of the lens and the X axis, and α is an angle between the line <u>BD</u> and the optical axis of the lens and β is an angle between the line <u>CD</u> and the optical axis of the lens when the source of the light is located at a D position.

The point of intersection (x0, y0, z0) is derived from the equations (1) and (2) and represented as follows:

$x0 = A[\tan(\theta + \alpha) - \tan(\theta + \beta)]/[\tan(\theta + \alpha) + \tan(\theta + \beta)]$ (3)

$z0 = -2A[\tan(\theta + \alpha) \cdot \tan(\theta + \beta)]/[\tan(\theta + \alpha) + \tan(\theta + \beta)]$ (4)

$y0 = [x0^2 + z0^2]^{1/2} \cdot \tan\phi$ (5)

Wherein ϕ is an angle between the line <u>AF</u> and the line <u>AD</u>.

Furthermore, assuming that the distance of z is constant, when four outputs of quantities of the light from one four-division PIN photodiode are indicated at P, Q, R and S, it is found from calculation that a direct proportional relationship exists between the ratio of the difference [(P+R)-(Q+S)] to the sum [(P+R)+(Q+S)] and the distance in the X-axis direction, and similarly a direct proportional relationship exists between the ratio of the difference [(P+Q)-(R+S)] to the sum [(P+R)+(Q+S)] and the distance in the X-axis direction. The calculation results are shown in Figs. 12 through 14. Figs. 12 through 14 show each relationship between the ratio of [(P+R)-(Q+S)]/[(P+R)+(Q+S)] and each distance in X-axis direction. Furthermore, it is also found from these figures that the product of the inclination of the gragh K and the position of z is a constant (c) of a substantially constant value.

From the gragh, R = K × z, K× (the position of z) = c. Therefore, x/(the position of z) = tan α = R/c. In this manner, the value of tan α can be obtained from the outputs of the one four-division PIN

photodiode. Similarly, tan β, tan θ can be obtained. More particularly, assuming that the outputs of the portions (50, 51, 52 and 53) and (60, 61, 62 and 63) of the two four-division PIN photodiodes 20 and 21 are (P, R, Q and S) and (P', R', Q' and S'), tan α becomes 1/c · [(P'+R')- (Q'+S')]/[(P'+R'+ Q'+S')], tan β becomes 1/c · [(P+R)- (Q+S)]/[(P+R+ Q+S)], and tan θ becomes 1/c · [(P+Q+P'+R')-(R+S+R'+S')]/[(P+R+ P'+R')+(Q+S+Q'+S')].

While, the aforegoing point of intersection (x0, y0, z0) is derived from the equation $\tan(\theta + \alpha) = (\tan\theta + \tan\alpha)/(1 - \tan\theta \tan\alpha)$, and the constant θ.

An explanation on the procedures of the calculation of the position will be made. Firstly, at the preparing stage, each parameter is set, and the inclination K of the line R-x of the graph (for example, Figs. 12 through 14), the product c and tan θ are previously obtained.

From the quantities of the light P, Q, R, S, and P', Q', R', S' received from the two four-division PIN photodiodes, the differential amplifier 23 outputs the sum [(P+R)+(Q+S)] and the difference [(P+R)-(Q+S)], the differential amplifier 26 outputs the sum [(P'+R')+(Q'+S')], and the difference [(P'+R')-(Q'+S')], and the differential amplifier 24 outputs the sum [(P+R+P'+R')+(Q+S+Q'+S')] and the difference [(Q+S+P'+R')-(R+S+Q'+S')].

Each ratio is calculated regarding each light receiving element by the position calculating circuit 22, and using the previously obtained values c and tan θ, the point of intersection (x0, y0, z0) is calculated. The calculations are made ragarding the two light receiving elements 10a and 10b, and thus the position and the posture of the position data transmitting device can be known by obtaining two points of the light emitting elements. Of course, using only one light emitting element, a three-dimensional position in space at one point can be obtained. Furthermore, the source of light

discriminating circuit 27 can discriminate each source of light through the sum outputs.

An explanation on operation of a wireless type of multi-dimensional position data input system will be made. When the mouse switch 11 of the position data transmitting device 5 is depressed, the control circuit 18 recognizes the depression of the mouse switch 11 to cause the the position data transmitting device 5 to be active, and at the same time to cause the pulse generator 15 to generate pulse signal of the light as shown in Fig. 8, so that the light emitting elements 10a and 10b alternately emit the light. At that time, the control circuit 18 checks the states of the click switches 12 and 13 to demand the pulse generator 15 to generate the click pulses corresponding to the states and the positon pulse of each of the light emitting elements. From these, the light emitting elements 10a and 10b emit the position pluses including the information of the click switches and the sources of the light as shown in Fig. 9.

The light receiving elements 20 and 21 receive these light pulses. these light pulses enter the click pulse detecting circuit 25 through the differential amplifiers 23 and 26. The click pulse detecting circuit 25 detects whether the click pulses are present and at the same time, the sources of the light are discriminated by the source of light discriminating circuit. The position calculating circuit 22 calculates the position of the position data transmitting device or the positions of the sources of the light of the position data transmitting device on the basis of the outputs from the differential amplifiers 23, 24 and 26. Then the position pulse is converted to the right angle abscissa and the click pulses are converted to the mouse click data, and these data are transferred through the connector 36 to the personal computer.

In this manner, the position in space and the posture of the position data transmitting device 5 are obtained, while the direction in movement and distance in movement of the cursor on the display of

the CRT 2 are specified by, for example, the on-state of the click switch 12.

As mentioned above, in accordance with the invention, when the position data transmitting device of a wireless type is moved in space, its position in space and/or posture can be inputted to the computer.

Of recent years, a production of a three-dimensional image of an object or a cubic figure is often made by using a computer graphic, a CAD, a CAM or the like. The present invention provides an input device , which is convenient in handling and low in cost, for inputting such data to the computer. Regarding the inputting of the size of the object, the size at three directions of x, y, and z axes can be inputted by tracing the outline of the object with the position data transmitting device in accordance with the present invention.

Furthermore, with a virtual reality, a user can easily input data by handling the position data transmitting device. Particularly, when operations are made in space, it is preferred that a wireless type of a compact device is used as an input device. The present invention can satisfy such a need.

WAHT WE CLAIM:

(1) A position data input system for a computer which comprises a position data transmitting device having at least one source of light capable of emitting a light pulse, and a position data receiving device including at least two light receiving elements for detecting the light incoming from said source of light and a calculating portion for calculating a three-dimentsional position of at least one portion of position data receiving device in space from the quantities of the light detected by said light transmitting elements.

(2) A position data input system according to claim 1 in which two sources of light are provided in said position data transmitting device, said calculating portion calculates three-dimentsional positions of two portions of position data receiving device.

(3) A position data input system according to claim 1 or claim 2 in which said light receiving elements are four-division PIN photodiodes which are disposed relative to each other at an angle, a three-dimentsional position of at least one portion of position data transmitting device is calculated on the basis of the difference between the quantities of light, the sum of the quantities of light, a distance between the light receiving elements and the disposed angle of the light receiving elements.

(4) A position data input system according to any preceding claims in which said position data transmitting device is constructed as a unit, said light receiving elements for receiving the light pulse including position pulse and click pulse emitted from said position data transmitting device are disposed within said position data receiving device.

(5) A position data input system according to

claim 4 in which said light pulse includes a direction pulse.

(6) A position data input system according to any preceding claims in which said position data receiving device as a unit is attached on a keyboard or a CRT body of the computer.

(7) A position data input system according to any of claims 1 to 5 in which said position data receiving device includes a charging portion for accommodating said position data transmitting device therein and charging the same.

(8) A position data input system according to any of claims 1 to 5 in which said position data receiving device is disposed at the side of a display of a lap top computer.

(9) A position data input system according to any preceding claims in which said position data transmitting device further includes one mouse switch and at least one click switch.

(10) A position data input system including a position data transmitting device and a position data receiving device in which

(a) said position data transmitting device comprises:

(i) a switch for making said position data transmitting device to be in an operation state,

(ii) at least one click switch for generating a click pulse,

(iii) at least one light emitting element for emitting a light pulse including a position pulse and a click pulse, and

(iv) a power supply for supplying an electric power to said light emitting element, and

(b) said position data receiving device comprises:

(i) two light receiving elements disposed in positions for receiving said light pulse including a position pulse and a click pulse emitted from said position data transmitting device,

(ii) a click pulse detecting circuit for recognizing said click

pulse,
(iii) a source of light discriminating circuit for discriminating sources of light,
(iv) a position calculating circuit for calculating the position in space of said position data transmitting device from the position pulse,
(v) a converting circuit for converting the position in space of said position data transmitting device obtained from said position calculating circuit to a mouse pulse,
(vi) a converting circuit for converting the position in space of said position data transmitting device obtained from said position calculating circuit to a three-dimensional position abscissa, and
(vii) a click pulse converting circuit for converting the click pulse obtained from said click pulse detecting circuit to a mouse click pulse.

(11) A position data input system according to claim 10 in which said light pulse emitted from the position data transmitting includes a direction pulse and said position calculating portion of said position data receiving device calculates the direction.

(12) A position data input system constructed substantially as described herein with reference to the accompanying drawings Fig. 1 or Fig. 5, together with Figs. 2 to 4 and 6 to 14.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search Report) -16-	Application number GB 9[illegible]548.9

Relevant Technical fields		Search Examiner
(i) UK Cl (Edition L)	G1A (AEE, AEN), H4D (DLPC)	R S CLARK
(ii) Int Cl (Edition 5)	G01B 11/03; G01S 5/16; G06F 3/033, 3/037	
Databases (see over)		**Date of Search**
(i) UK Patent Office		6 OCTOBER 1993
(ii) ONLINE DATABASE: WPI		

Documents considered relevant following a search in respect of claims

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2263546 A (DATA STREAM) - line 9, page 5 and line 28, page 11 to line 1, page 12	1, 3, 4, 6-10
X	WO 88/04060 A3 (STARPEAK) - pages 14-18	1-6, 10
X	WO 84/03774 (MORANDER) - page 10	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if c mbined with one or more other documents of the same category.

A: Document indicating technological background and/or stat of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of th same patent family, corresponding document.

Databas s: The UK Patent Offic database comprises classified collections f GB, EP, WO and US patent specificati ns as outlined periodically in the Official J urnal (Patents). The on-line databases considered for search are also list d periodically in the Official Journal (Pat nts).